

**Final Report to the Energy Efficiency Utility**

**Contract Administrator**

**Verification of**

**EVT 2008 Claimed Annual MWh Savings,  
Coincident Summer and Winter Peak Savings  
And Total Resource Benefit (TRB)**

**Department of Public Service**

June 12, 2009

# Table of Contents

<b>I. INTRODUCTION</b> .....	<b>1</b>
<b>II. SV 2008 VERIFICATION ISSUES</b> .....	<b>4</b>
<b>A. Sampling Issues and Stipulated Lighting Projects</b> .....	<b>5</b>
<b>B. Assumptions about Operating Schedules</b> .....	<b>5</b>
<b>III. PROJECT- AND MEASURE-LEVEL ADJUSTMENTS</b> .....	<b>7</b>
<b>A. Cross-Program Adjustments</b> .....	<b>7</b>
1. Coincident Peak Demand Reductions .....	7
<b>B. Business Sector (C&amp;I) and Multifamily Retrofit</b> .....	<b>7</b>
1. HVAC .....	7
a) Warming Hut Fuel Switch .....	7
b) Plastic Injection Molding Manufacturer - Cooling System Upgrades .....	8
c) Publication Printing facility - Ventilation Controls .....	8
d) Apartment Building Space Heat Fuel Switch .....	8
2. Lighting .....	9
a) Retail Drug Store Lighting .....	9
b) Elementary School - Lighting Upgrade .....	9
c) Plastic Injection Molding Manufacturer - Lighting (3 Projects) .....	9
d) Brewing Facility - Lighting .....	10
e) South Burlington Supermarket - Lighting and Refrigeration .....	10
f) Granite Sheds - Lighting.....	11
g) Episcopal Church - Lighting 1.....	11
3. Other Measures (REST) .....	11
a) Manufacturing Facility .....	11
b) Sheet Metal Manufacturing - Lighting Controls .....	12
c) Middle School HVAC Controls .....	12
d) Supermarket - Fan Motors .....	13
e) Downhill Ski Area - Freeaire.....	13
f) Multifamily Water Heater Replacement .....	14
g) Downhill Ski Resort - Snowmaking 4.....	14
h) Plastic Novelties Manufacturer - Lighting .....	15
i) Elementary School - Various Measures .....	15
4. Project with Multiple End Uses.....	16
a) University Research Laboratory.....	16
<b>C. Business Sector (C&amp;I) and Multifamily Market Opportunity/New Construction</b> .....	<b>18</b>
1. HVAC .....	18
a) Condominium Development - New Construction .....	18
b) Hotel and Conference Center- Lighting and Controls .....	18
c) High School - HVAC Renovation.....	18
d) State 911 Facility - HVAC .....	19
2. Lighting .....	19
a) Art Publishing & Licensing Facility – Lighting Plus .....	19
b) Heavy Construction Equipment Sales - Lighting Plus .....	20
c) Middle School - Lighting Plus LED.....	20

d)	Exhaust Pipe Manufacturer – Lighting Plus .....	21
e)	Railroad Offices - Lighting Plus.....	21
f)	Slate Company Office Building - New Construction .....	21
g)	Downhill Ski Resort Condominium.....	22
h)	Nonresidential Buildings Operators Service Office - Lighting Plus .....	22
i)	School District - Lighting Plus .....	22
3.	Other Measures (REST) .....	23
a)	Food Distributor.....	23
b)	Grocery Store - Addition and Renovation.....	23
c)	Plastics Manufacturer – Motors.....	24
d)	Insurance Company Office Building - Server Upgrade 3.....	24
e)	Elementary School - Lighting Plus.....	25
f)	Eyewear Manufacturer – Injection Molding.....	25
g)	Ski Resort Hotel.....	25
h)	Downhill Ski Area - Snowmaking .....	26
<b>D.</b>	<b>Stipulated Lighting Projects.....</b>	<b>27</b>
1.	Self Storage .....	27
2.	Lumber Store- Lighting Plus .....	28
3.	Middle School.....	28
4.	Housing Authority Apartments - CFL Switch (2 Projects) .....	29
<b>E.</b>	<b>Residential Adjustments .....</b>	<b>29</b>
1.	Home Performance with Energy Star.....	29
a)	Central A/C .....	29
b)	Shell Measures and Space Heat Efficiency.....	29
2.	Residential Existing Buildings (HPwES and LISF) .....	30
a)	CFL Lamps .....	30
b)	Refrigerator Replacements .....	31
3.	Efficient Products Program.....	31
a)	Energy Star Refrigerators .....	31
<b>IV.</b>	<b>ISSUES TO BE ADDRESSED ON A PROSPECTIVE BASIS.....</b>	<b>31</b>
<b>A.</b>	<b>Operating Hours .....</b>	<b>31</b>
<b>B.</b>	<b>Baselines for C&amp;I lighting .....</b>	<b>31</b>
<b>C.</b>	<b>Project Documentation and Availability of Information.....</b>	<b>31</b>
<b>D.</b>	<b>Act 250 Spill Over .....</b>	<b>32</b>
<b>E.</b>	<b>Technical Reference Manual (“TRM”) Reliability.....</b>	<b>32</b>
<b>V.</b>	<b>SAMPLING METHODS AND ANALYSIS.....</b>	<b>32</b>
<b>A.</b>	<b>Overview of Sampling .....</b>	<b>33</b>
<b>B.</b>	<b>Integration with the FCM Sample.....</b>	<b>34</b>
<b>C.</b>	<b>Sampling Issues .....</b>	<b>35</b>
<b>D.</b>	<b>Differences between the 2007 and 2008 Verification Sampling Plans.....</b>	<b>36</b>

<b>E. Weighting.....</b>	<b>36</b>
<b>F. Sampling Results.....</b>	<b>38</b>
<b>G. Stipulated Lighting Sample .....</b>	<b>42</b>
<b>H. Other Analysis Issues .....</b>	<b>42</b>

**DPS Verification of  
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Peak Savings, and Total Resource Benefit (TRB)**

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**I. Introduction**

On March 23, 2009, Efficiency Vermont ("EVT") submitted its "Year 2008 Preliminary Savings Claim" for calendar year 2008 activities operating as the statewide energy efficiency utility ("EEU"). As provided for in the contract between Efficiency Vermont and the Vermont Public Service Board ("PSB"), the Department of Public Service ("DPS" or "Department") undertook a review of EVT's 2008 activities, verifying the energy savings, coincident peak savings and Total Resource Benefit ("TRB") amounts claimed by EVT. This review was conducted by West Hill Energy and Computing, with assistance from Carole Welch, Cx Associates, GDS Associates and Lexicon Energy Consultants and oversight provided by the DPS. This report made to Michael Wickenden, Contract Administrator for the PSB, summarizes the results of that review.

The DPS provided preliminary findings to EVT and the Contract Administrator on May 18, 2009, with supplemental findings submitted on May 22, 2009. On May 26, 2009, Efficiency Vermont provided a response to the DPS preliminary findings on items where the DPS recommended an adjustment to the 2008 savings claim. EVT provided a response to the DPS supplemental findings on May 28, 2009. Agreement on savings adjustments was reached for all of the items identified in the DPS preliminary and supplemental findings.

EVT has indicated it accepts all of the adjustments to the 2008 claimed savings recommended by the Department in this report. In some cases, EVT does not completely agree with the Department's rationale or methodology for the adjustment, and requests that the measure characterizations for 2008 be discussed more thoroughly through the ongoing DPS-EVT TAG process. The Department has also identified several topics to be taken up in TAG process, as outlined in Section III, Issues to be Addressed on a Prospective Basis. Since the parties are in agreement on the magnitude of the 2008 adjustment, the issues and resolutions are briefly described. For more detail about the adjustments, please refer to the Department's May 18, 2009 preliminary findings, May 22, 2009 supplemental findings, and EVT's responses of May 26, 2009 and May 28, 2009.

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The Department appreciates Efficiency Vermont's position as a leading actor in the state's efforts to improve energy efficiency. EVT's leadership in promoting energy efficiency has been critical as the State of Vermont moves to acquire a high level of electric energy and demand savings

statewide and in geographically targeted areas of the state through market based strategies, while addressing the challenges of combating climate change.

The results of the Department's verification indicate that the 2008 energy savings claims are overstated by about 4.3%, or 5,042 gross annual MWh, and coincident peak savings are overstated by 6.8%, or 1,331 winter kW and 6.4%, or 1,105 summer kW. The Department's findings are the result of numerous adjustments both upward and downward.

The Department's program year 2008 verification process (SV 2008) drew on the concurrent evaluation of EVT's coincident peak savings for the Forward Capacity Market (FCM) to improve the estimates of coincident peak kW savings. The overlap between the two evaluation efforts provided the Department with more complete information and new tools for facilitating the verification process. For a few projects, the Department has conducted metering on site that provided additional information for estimating both coincident peak and energy savings.

In addition to the analysis of gross energy and demand savings, this review also covers net energy and demand savings, TRB, MMBtu savings from fossil fuels, and water savings. Some of the Department's recommended energy adjustments also have significant impacts on these other indicators. A few adjustments are targeted primarily at these other indicators, often adjustments to MMBtu savings. When EVT's savings are revised for its 2008 annual report, all of the relevant indicators will be re-calculated.

The Department is basing its recommendations on the review of a random sample of C&I projects. The sampling plan is consistent with that undertaken for the FCM evaluation. The sampling process was designed to ensure that the sample was weighted toward the larger projects that embody greater variability and more complex methods for calculating savings. Since the projects under review are reasonably representative of EVT's 2008 activity, the DPS is applying a proportional adjustment to the Business Sector (C&I) savings. This sampling and adjustment method should reflect what would result from a comprehensive savings review of all C&I projects, if resources and time permitted that approach.

Since many of the residential initiatives are primarily prescriptive in nature, the Department's review of this sector consisted largely of verifying that the agreed-upon assumptions as compiled in EVT's Technical Reference Manual (TRM) were correctly applied. This validation process is easily conducted for the entire data set, obviating the need for random sampling. The remaining initiatives are relatively small in magnitude and the Department primarily reviewed the larger residential projects with higher savings.

The random sample consisted of 86 C&I and multifamily projects covering the range of EVT initiatives in its business and multifamily sectors. In addition, a separate sample of 20 projects with lighting measures and stipulated load profiles was selected for review. A full discussion of the rationale for the sample of stipulated projects is provided in Section II.A.

The Department is recommending adjustments based on forty-one of the selected C&I and multifamily projects, i.e., issues were found with nearly half of the selected projects. While the

recommended adjustments are larger than for the program year 2007, the MWh<sup>1</sup> recommended adjustment is lower than in 2006 and in some prior years. However, the number of projects needing adjustment in either direction is significantly higher than in past years. As EVT matures, the quality of the savings claim should continue to improve. While no definitive conclusion can be drawn from these results, the Department suggests that EVT may want to consider reviewing its internal quality control process.

**Table 1: Summary of Adjusted Projects**

	Total # of Project/End Uses <sup>2</sup>	# of Project/End Uses in Sample	# of Project/End Uses with Project-Specific Adjustments
NC/MOP	668	40	21
Retrofit	424	46	25
Stipulated Lighting	562	20	5
Totals	2853	106	51

The relative precision for the realization rates associated with the maximum kW savings (kW Max)<sup>3</sup> for the Business and Multifamily retrofit initiatives, and the Business and Multifamily New Construction and Market Opportunity initiatives is 8.7% and 4.2% at the 90% confidence level, respectively.

The sample size for the stipulated lighting projects was based on the number of projects that could be reviewed within the time frame rather than achieving a specific level of statistical precision. The sampling precision for the stipulated lighting projects is 23.4% for the kW Max, but the precision for the energy savings is substantially lower (6.1%). The results of this verification process suggest that it is necessary to review projects with stipulated load profiles as well as those with non-stipulated load profiles. The sampling and adjustment process is described in more detail under Section VI, "Sampling Methodology and Analysis."

The adjustments to gross annual savings and coincident peak reductions for all initiatives are summarized in Table 2. The "Missed Measures" row in Table 2 reflects the savings for measures installed that were omitted from the initial data snapshot provided by EVT. These measures were not included in the sample. Since all of the measures were for NC/MOP projects, the NC/MOP realization rate was applied and the savings were added to EVT's totals.

<sup>1</sup> In part due to the Forward Capacity Market, the Department has increased the rigor with which demand savings have been verified in the recent two years. Thus, as a point of comparison, annual MWh are used here.

<sup>2</sup> There were 1756 projects with the maximum coincident peak reduction less than 0.8 kW. These projects were considered to be too small to evaluate and were not included in the sample or in this table.

<sup>3</sup> The primary sampling variable was the higher of the summer or winter coincident demand savings, referenced as "kW Max" throughout the remainder of this document.

**Table 2: Adjustments by Program Group**

	# of Projects	Energy Saved		Winter kW Reduction		Summer kW Reduction	
		MWh Adjust-ment	% Adj	kW Adjust-ment	% Adj	kW Adjust-ment	% Adj
C&I and Multifamily							
Retrofit	424	2,964	10.6%	732	18.2%	590	14.9%
NC/MOP	668	1,662	7.1%	306	10.0%	367	8.3%
Stipulated Lighting	20	509	5.4%	260	18.1%	284	16.8%
Missed Measures	10	-167		-3		-143	
Subtotal	1,112	4,967	8.3%	1,295	15.2%	1,097	10.9%
Residential							
LISF/REM	1,027	125	4.7%	41	7.9%	14	6.4%
EP		-51	-0.1%	-6	-0.1%	-6	-0.1%
RNC Single Family	419	0	0.0%	0	0.0%	0	0.0%
Subtotal	1,446	75	0.1%	35	0.3%	8	0.1%
Totals		5,042	4.3%	1,331	6.8%	1,105	6.4%

The DPS thanks the many staff members at Efficiency Vermont who coordinated the verification review, in particular, Bill Fischer and Erik Brown.

The remainder of this report is divided into five sections. Section II details some of the issues that arose with the SV2008 verification and their effect on the findings in this document. Section III details project and measure-level issues that provide the basis for the adjustments shown in Table 2 above. In Section IV, we discuss specific issues with program year 2008 (PY08) projects and other concerns to be addressed on a prospective basis. The final section describes the sampling methodology in more detail.

## **II. SV 2008 Verification Issues**

Several issues arose in the SV 2008 savings verification process that impact the findings in this document. These issues relates to 1) sampling complexities associated with the decision to have a consistent sampling strategy between the FCM evaluation and the annual verification for the PSB contract and 2) assumed operating schedules and the impacts on EVT's savings, particularly in the context of the current economic slowdown. These issues are explored further below.

## **A. Sampling Issues and Stipulated Lighting Projects**

The Department and EVT agreed that the sampling for annual verification and for the FCM evaluation should be as consistent as possible to allow for overlap between the two samples, a decision which had an impact on the Department's approach to sampling some lighting projects. For the FCM evaluation, the Department and EVT agreed to stipulated load profiles from the RLW lighting study for some measures.<sup>4</sup> Projects that fell into the large (census) stratum for the FCM were to be evaluated on a case-by-case basis for application of the stipulated lighting coincidence factors. This agreement was based on the assumption that the stipulated coincidence factors would be applied to the small and medium projects. Consequently, these measures were removed from the FCM and verification sample frames, since it is not necessary to meter these projects for the FCM.

However, the stipulated coincidence factors were not applied to the 2008 projects due to the difficulty for EVT in implementing the agreement within the time frame. Thus, the claimed savings for 2008 are based on the EVT's original coincidence factors, which do not meet the ISO-NE standard for the FCM but have been accepted for use in previous years for the PSB contract. The fact that the stipulated coincidence factors were not applied brings into question the rationale for omitting these projects from the sample.

In addition, the Department's review of the lighting projects in the sample brought attention to the fact that there are other critical inputs beside the coincidence factors affecting both the energy and demand savings, such as the baseline assumptions and hours of operation. This issue affects both the FCM evaluation and verification and may lead to an adjustment in the FCM sampling methodology.

Under these circumstances, the Department decided to review a sample of 20 small and medium projects with stipulated lighting measures. This review resulted in a reduction of more than 15% in the winter and summer demand savings for these projects, as indicated by the adjustments enumerated in Section III.D below. This outcome suggests that the coincident peak factors are not the only critical input for assessing the validity of the demand savings and that sampling the stipulated projects is a strategy that may need to be adapted to the FCM evaluation. For large lighting projects included in the main verification sample, the Department considered the application of the RLW coincident factors on a case-by-case basis and updated the coincident peak savings where it was appropriate.

## **B. Assumptions about Operating Schedules**

EVT estimates savings based on the operating schedule at the time of measure installation. However, basing savings on the conditions at the time of audit is not necessarily a reliable method of estimating savings over the measure life. Economic and other reasonably expected "life of the

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<sup>4</sup> RLW Analytics Inc., "Coincidence Factor Study Residential and Commercial & Industrial Measures" prepared for the New England State Program Working Group (SPWG), Spring 2007.

measure” cycles should be factored into the determination of the measure annual and lifetime savings.

The potential impact on estimated savings has become even more apparent during program year 2008. The C&I sample includes a number of projects where the hours of operation were found to be different than initially anticipated by EVT as businesses cut back hours in response to the current economic slowdown.

Due to the current economic downturn and increased contact with participants through the FCM evaluation, a number of installations have been identified where the operating hours are now dramatically less than assumed by EVT in its savings calculations. The Department has not made a concerted effort to determine how the current economic downturn has affected the 2008 savings estimates. Rather, information regarding specific projects has trickled in through the process of planning and implementing the FCM evaluation.

The Department made adjustments to two such projects to incorporate the effects of differing economic activity over a measure lifetime. In these cases, the facilities have dramatically decreased production and it is likely that substantially lower, if any, savings are being realized for some measures. The Department cannot in good conscience ignore these changes in conditions given the substantial impact on realized savings.

For both projects, the Department has made a default assumption that, over the life of the measure (typically 15 to 20 years), about one-third of the period will be consistent with the current operating schedule and two-thirds will reflect the original schedule assumed by EVT. The first year savings are assumed to be the weighted average over the measure life. This approach allows for some adjustment without unduly reducing the savings that, through no fault of EVT, are not currently being realized.

This approach is a response to the immediate issues that arose in the context of SV2008, and it is not intended to set a precedent for EVT to follow or necessarily to be used in future verifications. While this approach may meet the standards for verification, the Department acknowledges that it is likely this method could not be applied to the FCM savings given the more rigorous standard and the specified 5-year period for savings.

EVT has informed the Department that it does not agree with these adjustments. EVT takes the position that its process of estimating hours of operation based on current conditions is sufficient. However, EVT has also indicated that it will accept the Department's recommendations for the SV2008 projects for the purpose of facilitating the verification process. EVT agrees that the Department's method for making the adjustments should not be considered to be a precedent for EVT or for the Department's future verifications. The Department invites EVT to consider these issues and propose alternative strategies.

### **III. Project- and Measure-Level Adjustments**

#### **A. Cross-Program Adjustments**

##### **1. Coincident Peak Demand Reductions**

This issue was identified and described in more detail in the SV 2007 process. EVT's screening tool automatically adjusts the coincident peak demand reductions (both summer and winter) proportionally according to the relationship between the actual hours of use and the hours of operation used as the underlying foundation of the load profile.

As previously described, the Department does not find this process of scaling for the hours of use appropriate in C&I establishments that operate more than 3,200 hours per year. In these cases, running more hours would not result in an increased probability that the equipment would be running during the peak hours. The scaling for hours of use also has an interactive effect with the cooling bonus adjustment, in some cases resulting in a winter coincident peak reduction that is higher than the total possible kW reduction.

The Department recalculated the coincident peak savings for the measures in the sample to correct both for the overstatement of maximum kW load for lighting measures with the cooling bonus and for the scaling of the coincident peak reductions (where appropriate). These adjustments are included in the realization rates presented in Table 2 above.

The Department has provided a list of the modified measures to EVT in a separate file. Some of the projects identified for measure-specific adjustments in the sections below are also included on this list of adjusted projects. In these cases, the measure-specific adjustment took precedence.

#### **B. Business Sector (C&I) and Multifamily Retrofit**

##### **1. HVAC**

- a) Warming Hut Fuel Switch  
EVT Project ID: 265168  
MAS 90 Project ID: 6012-7802  
Size Stratum: 2

This retrofit project consists of an electric space heat to propane heat fuel switch conversion. A bin hour analysis method was used to determine heating load hours. The estimated load of the building was based on the two 10kW electric heaters and then reduced by 10% based on a high traffic and infiltration rate of the building.

The DPS adjusted the savings by allowing savings only during the snowmaking season, and by changing the sizing factor from 90% of electric heater name plate to 50%.

These changes reduce the annual savings from 22,863 kWh to 11,027 kWh. The winter kW remains the same at 9.2 kW and the summer kW should be reduced from 0.048 to zero.

- b) Plastic Injection Molding Manufacturer - Cooling System Upgrades  
EVT Project ID: 275769  
MAS 90 Job: 6012-8060  
Size Stratum: 5

This manufacturer replaced an existing water cooled chiller with a new, similarly sized screw compressor chiller and installed a filter in the condenser water system for a central water cooled chiller plant

Adjustments to the claimed savings were made to correct the chiller load assumed in EVT calculations and to incorporate the impact of a 20 HP pump omitted from the original estimate.

These changes reduce the claimed energy savings by 10,845 kWh, increase the claimed winter demand savings by 0.941 kW, and increase the claimed summer demand savings by 13.261 kW.

- c) Publication Printing facility - Ventilation Controls  
EVT Project ID: 248181  
MAS 90 Project ID: 6012-7374  
Size Stratum: 5

This manufacturing facility underwent renovations that included the addition of variable frequency controls to existing exhaust fans, air handlers and air conditioning units. This installation was divided into two measures, one characterizing the fan savings and the other the cooling savings.

For the fan measure, the DPS revised the assumed reduction in the air flow rate from the air handlers and corrected the savings accordingly. The cooling measure savings were adjusted to reflect the revised air flow rate. In addition, EVT did not provide sufficient information for DPS to verify the claimed fossil fuel savings for the heat recovery portion of this measure.

These corrections result in reductions of 23,976 gross, annual kWh, 3.66 winter kW and an increase of 2.41 summer kW, and a decrease of 5,355 MMBtu.

- d) Apartment Building Space Heat Fuel Switch  
EVT Project ID: 2224314  
MAS 90 Job: 6017-5625  
Size Stratum: 1

This project is a space heat fuel switch from electric to fuel oil for an elevator room.

The DPS corrected a data entry error to reflect a measure savings of 2,843 kWh, a savings increase of 361 kWh.

## 2. Lighting

- a) Retail Drug Store Lighting  
EVT Project ID: 223619  
MAS 90 Project: 6012-5490  
Size Stratum: 5

This project includes relamp/reballast and hi-bay fixture replacements in conditioned office, mezzanine and refrigeration spaces, and in unconditioned warehouse spaces. EVT used its standard load profiles to estimate savings for this retail store.

The Department corrected the coincidence peak factors for the warehouse hours, which are clearly stated to include 100% of summer peak hours and 90% of winter peak hours. The RLW stipulated coincidence factors were applied to the office spaces.<sup>5</sup>

Correcting the CFs results in a winter peak demand reduction of 7.098 kW and an increase in summer peak kW demand savings of 3.271 kW from EVT's savings claim. The Department does not recommend any change to the kWh savings.

- b) Elementary School - Lighting Upgrade  
EVT Project ID: 232978  
MAS 90 Project: 6012-7003  
Size Stratum: 2

This project is a lighting retrofit for an elementary school that was metered as part of the Forward Capacity Market ("FCM") evaluation. The project includes relamp/reballast from efficient T-8 to high performance T-8 lamps and ballasts for 125 2-lamp fixtures and 246 4-lamp fixtures.

The metering process revealed that the installed equipment has a larger watt load than used in the EVT estimate, the surveyed hours of operation were not accurate, and the peak coincidence factors are generally overstated in the EVT savings claim.

Correcting the savings calculations for all these factors results in a reduction of 2,569 gross, annual kWh, and the winter and summer peak demand savings reduction of 3.94 kW and 2.30 kW respectively.

- c) Plastic Injection Molding Manufacturer - Lighting (3 Projects)  
EVT Project IDs: 274866, 336773, 22641 (three locations)  
MAS 90 Project ID: 6012-8047, 6012-C034, 6012-6050  
Size Stratum: 5, 4, 5

EVT assisted this manufacturer with extensive lighting retrofits in three separate locations. EVT based its savings on undocumented vendor claims for wattage of the efficient lights rather than the

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<sup>5</sup> RLW Analytics Inc., "Coincidence Factor Study Residential and Commercial & Industrial Measures" prepared for the New England State Program Working Group (SPWG), Spring 2007.

standard default values for lighting technologies found in EVT's technical reference manual ("TRM") or comprehensive analysis tool ("CAT").

Vendor values should not override standard assumptions unless there is documented support for their use. The Department's adjustments increased the savings for some measures and decreased them for others.

For project 274866, the savings are reduced by 30,208 gross, annual kWh and winter and summer coincident peak savings by 8.483 kW each. The adjustments to project 336773 result in a reduction of 16,067 gross, annual kWh, .022 winter peak kW and an increase of 2.644 summer peak kW. For project 226241, recalculating the savings using standard default values results in an increase of 5,093 annualized kWhs, a reduction of 16.077 winter KW, and a reduction of 15.036 summer KW.

- d) Brewing Facility - Lighting  
EVT Project ID: 315573  
MAS 90 Project ID: 6012-9129  
Size Stratum: 2

This lighting project includes various fixture upgrades as well as installation of occupancy sensors at this brewery. The Department's review found an error in a baseline used for one of the bathrooms and that the savings calculation for the occupancy sensors in the office area did not reflect upgraded lighting fixtures also installed as part of this project.

Making these two adjustments result in a reduction of 2,338 gross annual kWh, 0.286 winter coincident kW and 0.551 summer coincident kW.

- e) South Burlington Supermarket - Lighting and Refrigeration  
EVT Project ID: 372314  
MAS 90 Project: 6012-D543  
Size Stratum: 5

This project involved a lighting retrofit that occurred as part of rebranding a supermarket.

The Department adjusted the savings to take into account the store's holiday schedule and also to correct the waste heat penalty for the lighting measures. EVT revised the baseline for the metal halide fixtures,

The total adjustment results in a reduction of 43,015 gross annual kWh, 10.913 winter peak kW and 7.128 summer peak kW savings, and in increase in MMBtu savings of 84.8.

- f) Granite Sheds - Lighting  
EVT Project ID: 243167  
MAS 90 Project: 6012-7274  
Size Stratum: 5

EVT and Grainger performed a lighting audit of the granite manufacturing facility. Incentives were provided for 100% of the existing lighting fixtures to replace Metal Halides with T5 high output fluorescent fixtures.

Savings were calculated based on a 2-shift operation of 80 hours a week for 52 weeks of the year or 4,140 hours per year. These hours were applied to all locations in this project. Lacking detailed information on holiday and vacation shutdowns, a minimum of nine holidays should be assumed. This reduces the hours of operation to 3,996 hours per year for this project.

The DPS recommends a reduction of 13,484 gross, annual kWh for this project to correct for the overstatement of hours.

- g) Episcopal Church - Lighting 1  
EVT Project ID: 371930  
MAS 90 Project ID: 6012-D394  
Size Stratum: 1

This project consists of 18 screw-base 100-Watt compact fluorescent lamps installed in hanging lanterns in a church. Savings were estimated using a custom annual operation of 2,184 hours and the load profile included the cooling bonus, although there was no documentation that the space had air conditioning.

This unusual application suggests that the lights were installed in either the sanctuary or the chapel. Further research suggested that EVT substantially overstated the estimated hours of operation and peak demand savings. The Department adjusted the savings estimate to reflect the lower annual hours of use, with no coincident peak demand reduction and no cooling bonus.

The energy savings should be reduced by 5,944 gross, annual kWh and the winter and summer coincident peak savings by 1.078 kW and 2.090 kW, respectively.

### **3. Other Measures (REST)**

- a) Manufacturing Facility  
EVT Project ID: 351176  
MAS 90 Project ID: 6012-C369  
Size Category: 2

This measure removed a 100-hp compressor from service, installed a 30-hp VSD trim compressor and re-instated an existing 50-hp compressor into service. Savings were based on the assumption that the facility would be operating 2 shifts over the entire measure life.

EVT informed the Department that this manufacturing facility has cut back from two shifts to one as a result of a downturn in business. Thus, the savings achieved at this site will be substantially lower than expected in the near term.

The Department corrected an error in the estimation of the winter and summer peak demand (resulting in an increase in demand savings) and also adjusted the savings based on the assumption that the facility will operate one shift for one-third of the 15-year measure life, and two shifts for the remaining two-thirds of the measure life.

The Department reduced the energy savings by 19,379 gross, annual kWh. The winter and summer coincident peak savings were increased by 1.233 and 6.073 kW, respectively.

- b) Sheet Metal Manufacturing - Lighting Controls  
EVT Project ID: 305273  
MAS 90 Project ID: 6012-8958  
Size Stratum: 1

This project involves the installation of occupancy sensors to control fluorescent light fixtures in a sheet metal manufacturing facility. EVT assumed daytime operation of the sensors during weekday business hours in the workshop portion of the facility. The assumed fixture type for EVT's analysis was 8 foot long 2-lamp T12 fixtures with magnetic ballasts.

From site visits and metering done for the FCM, the Department found that baseline conditions are different from EVT's assumptions in terms of the use of the space, the number of fixtures controlled by the sensors, the fixture types and the use of a time clock in addition to the occupancy sensors. Also, during an interview with the customer, the Department learned that some of the T12 lights stay on all the time, and are not controlled by the occupancy sensors or the time clocks.

Adjusting the savings estimate to reflect this information increases the winter peak demand savings by 0.079 kW, decreases the summer peak kW demand savings by 0.383 kW and increases the gross annualized energy savings by 744 gross, annual kWh. These changes will also affect the fossil fuel waste heat penalty.

- c) Middle School HVAC Controls  
EVT Project ID: 227233  
MAS 90 Project ID: 6012-6268  
Size Stratum: 3

The measures consist of fitting three existing air handler fan motors with new high efficiency motors, installing DDC controls on three existing air handlers and reducing the air handler air heating load by reducing the volume of outside air. In addition, six VFDs were installed on the supply and return fans. For the high efficiency fans, the EVT analysis used prescriptive default values for new high efficiency motor replacements.

The Department adjusted the savings to account correctly for the interactive effects between the

new VFDs, the fans and the DDC system. In addition, the Department had insufficient information to verify the natural gas savings associated with the DDC system.

The Department recommends increasing the energy savings by 10,617 kWh, reducing the winter and summer demand savings by 2.307 kW and 12.968 kW respectively, and reducing fossil fuel savings by 64.0 MMBtu/Yr.

- d) Supermarket - Fan Motors  
EVT Project ID: 6012-C449  
MAS 90 Project: 6012  
Size Stratum: 1

This project consists of replacing existing shaded pole evaporator fan motors with new brushless DC fan motors in selected freezers and coolers at a supermarket in Lamoille County. EVT estimated savings for this measure using its standard assumptions.

On site power measurements for the efficient fans were taken as part of the FCM evaluation.. Measured power was slightly higher for the freezer fans than assumed by EVT and substantially lower for the cooler fans.

Based on the on-site power measurements, the annual energy savings are reduced by 6,012 gross kWh, winter kW savings by 0.686 kW and summer kW savings by 0.686 kW.

- e) Downhill Ski Area - Freeaire  
EVT Project ID: 302576  
MAS 90 Project ID: 6012-8913  
Size Stratum: 2

This customer installed three refrigeration measures: (1) ECM evaporator fan motors, (2) evaporator fan controls, and (3) refrigeration economizers at several locations. Several coolers received multiple measures, e.g. 30 measures were installed on 16 coolers. EVT used the TRM methodology and a combination of standard TRM assumptions combined with site-specific assumptions in places.

The Department found that EVT's savings estimate methodology did not properly account for interaction between measures installed on the same unit. A number of adjustments were made to incorporate interactive effects and provide consistency in some related assumptions.

As a result of the numerous changes in assumption, the energy savings for this project are decreased by 7,598 gross, annual kWh. Winter coincident peak savings should be increased by 3.419 kW and summer coincident peak savings reduced by 0.24 kW.

- f) Multifamily Water Heater Replacement  
EVT Project ID: 252980  
MAS 90 Project ID: 6017-7528  
Size Stratum: 2

This low income multifamily project was apparently initiated in 1996, before Vermont Energy Investment Corporation (“VEIC”) provided services as Efficiency Vermont, Vermont’s Energy Efficiency Utility. At that time, VEIC did a study for this participant and recommended a domestic water heating fuel switch from electric to propane. In the spring of 2007, the water heating tanks were failing and the participant initiated the process to replace them with propane tanks. The savings calculations were based on electrical data from the prior VEIC proposal and analysis done in 1996.

EVT assumed that the baseline for this MOP project was electric DHW, but there was no documentation in the files to support this assumption. It is, however, apparent from the project files that EVT was working with this participant throughout the last several years.

Given the lack of clear documentation of the baseline, the Department assumed that electric DHW replacement would occur in 50% of low income multifamily buildings, and another fuel would be selected in the remaining 50%, resulting in a blended baseline of 50% electric DHW and 50% fossil fuel. Consequently, the Department reduced the electric savings by 50% and decreased the additional MMBtu of fossil fuel use accordingly.

The Department recommends that the electric savings for this measure be reduced by 80,269 gross, annual kWh, 12.706 winter kW and 6.432 summer kW. The estimated increase in additional oil use should be reduced by 328.5 MMBtu.

- g) Downhill Ski Resort - Snowmaking 4  
EVT Project ID: 313272  
MAS 90 Project ID: 6012-9098  
Size Stratum: 5

This project involves replacement of 90 Ratnik Snow Giants with 90 new HKD tower guns: 30 HKD SV10 guns installed in 2007 and 60 HKD LV4400. The project documentation states that it is the customer’s goal to make all of their snow with low-e guns powered by diesel compressors.

The information in the project files does not match the assumptions used by EVT to estimate savings. This project lends itself well to a whole-mountain approach since it is expected that all snow-making will be by low-e guns after installation. The Department recalculated the savings based on a whole-mountain analysis and the information available in the project files.

The Department recommends a reduction of 330,508 gross, annual kWh, 3,449 annual MMBtu, and 50.2 kW winter peak savings.

- h) Plastic Novelties Manufacturer - Lighting  
EVT Project ID: 275669  
MAS 90 Project ID: 6012-8058  
Size Stratum: 2

This project includes a lighting retrofit, occupancy sensors and a chiller. The occupancy sensors and the chiller, characterized as a refrigeration chiller, were reviewed for this report.

Occupancy-based lighting controls were installed in both the plastic novelties and an adjacent manufacturer warehouse areas. Occupancy/Light loggers were installed prior to the measures installation in one affected area for each building occupant to estimate savings. Based on this data, EVT claimed an 80% reduction in lighting run-time for the adjacent manufacturer and an 84% reduction for the plastics manufacturer. EVT estimated the annual hours of use from the participant.

EVT also claimed savings for a portable nominal 10 ton packaged air cooled chiller for process manufacturing. EVT determined the new chiller performance kW per ton based on the manufacturer's full load amp rating for the chiller package. The baseline chiller performance was calculated using similar methodology.

EVT informed the Department that the logged data was reliable, with the possible exception of some hours recorded as "occupied/lights off," which EVT speculated could be a result of the warm-up time associated with the metal halide fixtures. The Department conducted its own analysis using this information and assuming that half of the "occupied/lights off" hours were actually "occupied/lights on." The Department also estimated the annual hours of operation from the logged data.

For the chiller, the DPS was unable to find adequate documentation or analysis to support the savings claim for this measures. Consequently, the Department was unable to confirm that the portable chiller meets the required efficiency standard. In addition, EVT's approach to estimating the savings for this measure was inappropriate because the compressor kW per ton calculation included elements other than just the compressor and used incorrect values for chiller kW.

The Department recommends that the lighting control and refrigeration measures be reduced by 58,608 gross, annual kWh, winter peak coincident peak demand savings by 13.66 kW and summer coincident peak demand savings by 18.09 kW.

- i) Elementary School - Various Measures  
EVT Project ID: 274095  
MAS 90 Job: 6012-8028  
Size Stratum 1

This lighting efficiency project at an elementary school includes occupancy sensors whose savings were reviewed for this verification. EVT estimated operating hours primarily based on default values.

The Department metered this site and interviewed the facility manager for the FCM evaluation and found that the baseline hours of use for the gym is higher than EVT's assumption. Prior to the installation of the occupancy sensors, it appears that the gym was open and lit for 2,500 hours per year, although it was not occupied during the entire time. Once the occupancy sensors were in place, the gym lighting was in use for a total of 1,673 hours a year. This change represents an increase to EVT's claimed energy savings.

The metered data also shows the gym occupancy hours during the coincident peak periods is less than assumed by EVT and thus results in lower coincident peak factors. This reduces the claimed summer and winter coincident peak KW.

These adjustments result in an increase of 650 gross, annual kWh, a decrease of 0.012 kW winter kW peak savings, a decrease of 0.016 summer kW, and a decrease of 0.794 to the MMBtu for additional fuel use (waste heat).

#### **4. Project with Multiple End Uses**

- a) University Research Laboratory  
EVT Project ID: 283380  
MAS 90 Project ID: 6012-8210  
Strata: HVAC Size 2/REST Size 3

This Research Laboratory project was randomly selected under two separate end uses, HVAC and REST. The initial discussion covers issues that affect both sets of end uses. This discussion is followed by the measure-specific adjustments for each project/end use.

EVT provided incentives for replacing the existing heat pumps and lighting with new equipment and for the installation of lighting controls. The project was included in the C&I retrofit track and the analysis used the existing equipment for baseline.

This project should have been characterized as new construction rather than retrofit, and the baseline should be the Vermont Energy Code. It included the replacement of several building systems including lighting, power, HVAC, fire alarm, walls and ceilings and lab hoods in more than 30,000 square feet of space. A renovation of this scope clearly must comply with the Vermont Energy Code and should be considered new construction.

- i. HVAC  
Size Stratum: 2  
Measure ID: 1446870

The participant replaced existing heat pumps with new ones. EVT used the COP/EER of the existing equipment as baseline when calculating savings, rather than code minimums. The existing COPs of the existing heat pumps were below code minimum, hence the resulting calculated savings are overstated. EVT used a heating COP of 2.98, whereas the 2005 Vermont Guidelines for Energy Efficient Commercial Construction requires a water source heat pump in heating mode to have a COP of 4.2 (Table 803.2.2(2)).

Correcting the baseline efficiency reduces the kWh claimed for the heat pump replacement by 111,654 kWh, and the winter and summer coincident peak demand savings by 10.683 KW and 10.193 KW, respectively.

ii. REST Measures  
Size Stratum: 3

This component involved adding daylighting controls, occupancy sensors and a combination of lighting efficiency measures identified in EVT's database as lighting control measures. The EVT analysis used the existing fixtures, including a significant amount of incandescent lighting, as the baseline.

Efficiency Vermont approached this lighting efficiency portion of this project as a retrofit. For reasons noted above, the DPS categorizes this project as a major renovation. The Vermont Commercial Energy Code should be used as a baseline.

For the daylighting controls, the Department adjusted the estimated energy and demand savings to reflect a more realistic daylighting control strategy and the lower baseline. In addition, EVT's application of the standard lighting load profile to the daylighting load reduction is not an appropriate method to determine the load reduction during the performance periods.

For the occupancy sensors, the DPS applied the RLW stipulated coincident factors and corrected the controlled kW load.

No interactive effects were included in the lighting control analysis. Where fixtures are controlled by both daylight sensors and occupancy sensors, the percent reduction of the occupancy sensor control should be reduced accordingly.

In addition, there was an error in the entry of the MMBtu savings reflecting the waste heat penalty. Rather than reflecting an increase in fossil fuel use, the database entry indicated additional fossil fuel savings. It appears that the waste heat penalty was entered as a positive value (savings) rather than a negative value (additional use).

Making these corrections reduces the claimed annual energy savings by 143,044 kWh, the winter peak demand by 22.671 KW and the summer peak demand by 29.617 KW. The additional fossil fuel use should be increased by 155.188 MMBTU.

## **C. Business Sector (C&I) and Multifamily Market Opportunity/New Construction**

### **1. HVAC**

- a) Condominium Development - New Construction  
EVT Project ID: 228801  
MAS 90 Project ID: 6019-6478  
Size Strata: 3

This project involved replacing the existing garage exhaust system, which is a full flow, constant volume system that runs continuously, with a variable speed system that only maintains minimum flow. In addition, the boilers were upgraded to more efficient models, and dedicated heat recovery ventilation (“HRV”) units were provided for each apartment.

EVT calculated the savings for the dedicated HRVs using a calculated fan kW instead of using the manufacturer's total unit kW (wattage) at operating conditions. The EVT calculated kW is 0.00339 while the manufacturer's literature notes an operating wattage of 72 watts (for both fans, divided by two for supply fan=36 watts or 0.036 kW). As the manufacturer's data is based on the actual fan curve of the installed equipment, those numbers should be used to calculate the measure savings. The Department also identified an error in EVT's boiler replacement savings calculation that was corrected.

These changes result in a reduction of 20,020 annual kWh and 103.9 MMBtu/yr for the boiler replacement and HRV measures.

- b) Hotel and Conference Center- Lighting and Controls  
EVT Project ID: 222757  
MAS 90 Job: 6013-5322  
Size Stratum: 2

This facility underwent renovations in 2008 that included a setback thermostat to control nighttime use of roof top air handling units serving the conference center.

The savings for this measure occur between 11 PM and 6 AM, so there would be no coincident peak capacity savings. Therefore, the winter and summer coincident peak savings should be removed, resulting in a reduction of 7.670 winter kW and 0.040 kW summer kW.

- c) High School - HVAC Renovation  
EVT Project ID: 229985  
MAS 90 Project: 6013-6596  
Size Stratum: 3

The High School renovated its HVAC system, including several measures for VFD drives which use a drive efficiency of 97% to account for VFD burden. There are also new efficient motors as

well as a control system upgrade. The chiller system upgrade to a new system includes a Cal-Mac ice storage system

The savings estimate for the chiller system upgrade was recalculated to account for tank losses from the Cal-Mac tanks after the DPS review revealed these losses had not been taken into account in the original savings estimate. from the Cal-Mac tanks when calculating the savings for the chiller system upgrade.

The savings for the chiller system upgrade should be reduced by 2,851 gross, annual kWh, from 13,120 kWh to 10,269 kWh. There is no adjustment to the winter or summer peak kW or the MMBtu.

- d) State 911 Facility - HVAC  
EVT Project ID: 310479  
MAS 90 Project ID: 6013-9054  
Size Stratum: 2  
Measure ID: 1519655

This project installed a chilled water system with a water-side economizer in place of a DX system with an air-side economizer. The building houses sensitive electronic equipment and is maintained at 70°F and 35% relative humidity year-around. The water-side economizer allows the ventilation air to be reduced from 2,500 cfm to 200 cfm, therefore reducing the load on two existing 11.4-kW humidifiers. The savings are based on reducing the use of the humidifiers. An expected decrease in air-conditioning efficiency partially offsets the expected savings.

The Department was unable to verify the savings based on EVT's project files due to lack of documentation and clearly inappropriate savings calculations. EVT subsequently provided additional information and a revised analysis. The Department's recommendation is based on EVT's revised analysis.

The Department recommends reducing the gross annual energy savings by 6,288 kWh, and the winter and summer coincident peak savings by 6.500 and 1.200 kW, respectively.

## **2. Lighting**

- a) Art Publishing & Licensing Facility – Lighting Plus  
EVT Project ID: 322415  
MAS 90 Project: 6021- A842  
Size Stratum: 2

This project involved an extensive lighting retrofit. EVT used the vendor's claim for the wattage of the efficient lights.

The vendor used their own assumptions for the standard wattages of the efficient lighting products. EVT's savings are based on the vendor's values rather than their standard default values from the lighting technologies table in the CAT or from the TRM.

The Department recommends decreasing energy savings by 2,482 gross, annual kWh, as well as reducing winter and summer coincident peak kW by 0.304 and 0.589 summer kW, respectively.

- b) Heavy Construction Equipment Sales - Lighting Plus  
EVT Project ID: 322613  
MAS 90 Project ID: 6021-B040  
Size Stratum: 2

EVT's direct install contractor conducted a lighting audit including fixture counts, hours of operation, and recommended replacements. The projects were analyzed using a track specific input tool and run through the CAT. Hours of operation were based on a walkthrough and discussion with the owner's representative. The Department understands that all lighting in the facility was reviewed and considered for replacement.

The Department adjusted the energy savings for this project for two reasons. First, the hours of use do not include holidays. Second, the Department noted that the savings are based on the assumption that all of the lighting in the facility are on at all times when the facility is open. The RLW study on lighting coincident factors indicates that commercial establishments typically have 80% of the lights on at any given time. The Department's adjustment reflects 100% on time for specific part of the facility where this assumption is justified.

The energy savings should be reduced by 2,011 gross, annual kWh. No adjustment is recommended for the winter or summer peak savings. The additional fossil fuel needed for space heating should be reduced by 6.2 MMBtu.

- c) Middle School - Lighting Plus LED  
EVT Project ID: 368585  
MAS 90 Project: 6021-C748  
Stratum: 2

This project includes the replacement of twenty 250W metal halide fixtures with twenty LED 60 fixtures in the Essex School Complex parking lots and the replacement of gym fixtures with 4 Lamp T5-HO fixtures. Load shape 63a was used in the analysis of this gym fixtures.

Based on the invoice indicating that there were two inoperative fixtures in the parking lot, the Department derated the baseline quantity from 20 to 18. Given that there is no documentation of air conditioning in the gym, the Department removed the cooling bonus for this measure. The Department also reduced the operating hours for the gym to 2,600 hours per year.

The DPS recommends reducing the gross, annual kWh by 12,854, and the winter and summer coincident peak savings by 3.805 kW and 3.663 kW, respectively.

- d) Exhaust Pipe Manufacturer – Lighting Plus  
EVT Project ID: 301786  
MAS 90 Job: 6021-8767  
Size Stratum: 4

This is a lighting retrofit project for an existing manufacturing facility. Super T-8s were installed to replace existing metal halide fixtures.

For its savings calculation, EVT assumed the baseline number of fixtures equals the installed quantity of new fixtures. However, the engineering document showed a baseline of far fewer metal halide fixtures.

Correcting the baseline quantity results in a decrease of 72,414 kWh in energy savings for this project, a decrease of 11.55 kW winter peak savings, a decrease of 15.49 KW summer peak savings, and a decrease of 1.646 from the MMBtu waste heat adjustment.

- e) Railroad Offices - Lighting Plus  
EVT Project ID: 322583  
MAS 90 Project ID: 6021-B010  
Stratum: 2

EVT's direct install contractor conducted a lighting audit including fixture counts, hours of operation, and recommended replacements. A large number of efficient lighting products were installed. The projects were analyzed using a track specific input tool and run through the CAT. Hours of operation were based on a walkthrough and discussion with the owner's representative.

The Department's review of the pre-installation billing records suggests that the savings are overstated. The billing records are not consistent with a facility that has regular 24/7 use, as assumed by EVT. EVT has been unable to reconcile the billing records with their knowledge of the facility, and has suggested that there may be another electric meter that is not currently linked to this site in EVT's database. The Department allows for this possibility, and recommends a moderate adjustment to these savings to account for the uncertainty in the actual usage patterns.

The Department's adjustments for the lighting only measures (excluding the controls) reduces the energy savings by 36,743 kWh annually, winter peak savings by 1.982 KW, and summer peak savings by 3.052 KW.

- f) Slate Company Office Building - New Construction  
EVT Project ID: 273470  
MAS 90 Project ID: 6014-8015  
Size Stratum: 1

This newly constructed office building included installation of CFL, circline fluorescent T8 fixtures, and fluorescent tube T8 fixtures to meet and surpass Vermont Commercial Construction code lighting density requirements.

The savings claim calculation used an erroneous assumption for the annual hours-of-use. This was corrected to reflect that the circline and super T-8 fixtures in the entry, kitchen, offices and shop operate for an estimated 2,520 hours/year.

This correction results in a reduction of 2,123 gross, annual kWh, 0.275 winter peak kW and 0.494 summer peak kW. In addition, the MMBtu waste heat penalty should be decreased by 3.2 MMBtu.

- g) Downhill Ski Resort Condominium  
EVT Project ID: 221126  
MAS 90 Project ID: 6019-5111  
Size Stratum: 2

Lighting measures for this condo project include relamp and ballast measures in individual units as well as CFLs. EVT calculated the savings that applied a cooling bonus to some spaces that are unlikely to be air conditioned, such as the garage and the mechanical room.

The Department removed the cooling bonus from the savings calculation for the lighting upgrades installed in spaces without air conditioning. This adjustment reduces the energy savings by 2,653 gross, annual kWh, and demand savings by 1.545 winter kW and 2.995 summer kW.

- h) Nonresidential Buildings Operators Service Office - Lighting Plus  
EVT Project ID: 323155  
MAS 90 Project ID: 6021-B582  
Size Stratum: 1

The EVT direct install contractor conducted a lighting audit including fixture counts, hours of operation, and recommended replacements.

Project savings claims were based on audited weekly hours of occupancy for 52 weeks per year. Nine holiday days should be included in the calculation. This results in a 3.5% reduction in the run hours and a commensurate reduction in kWh.

Making this change reduces the energy savings by 338 kWh annually. No adjustments to the coincident peak reductions were made.

- i) School District - Lighting Plus  
EVT Project ID: 322493  
MAS 90 Project ID: 6021-A920  
Stratum: 2

EVT direct install contractor conducted a lighting audit including fixture counts, hours of operation, and recommended replacements. Hours of operation were based on a walkthrough and discussion with the owner's representative.

The savings were estimated used the cooling bonus for most measures, although no documentation was provided that air conditioning was present in the classrooms. This project claimed savings based on audited weekly hours of occupancy for 52 weeks per year for non-classroom spaces. Holiday days and vacation shut down periods for school and district offices should be included in the calculation. In addition, the Department was not able to match up the specific measures to the documentation.

EVT revised its analysis of this project, checking the measures against the documentation, adjusting the operating hours to reflect the school calendar, removing the cooling bonus where appropriate and making the other required adjustments using the correct load shapes and operating hours. The Department accepted the new savings estimates.

The Department recommends that the energy savings be reduced by 19,558 gross, annual kWh, and the winter and summer peak savings by 0.626 kW and 5.734 kW respectively. The Department requests that EVT make the appropriate adjustment to the waste heat penalty.

### **3. Other Measures (REST)**

- a) Food Distributor  
EVT Project ID: 350272  
MAS 90 Job: 6013-C344  
Size Stratum: 2

EVT provided incentives for market opportunity efficiency improvements to the air compressor system at a food distributor. The participant replaced an existing compressor at the end of its useful life with new VFD controlled compressor. The second measure consisted of reducing the pressure set-point of a central compressed air system from 125 PSIG to 106 PSIG, with a measure life of ten years.

The DPS understands that EVT recommended the participant lower the pressure set-point from 125 for 106 psig and the participant agreed to try it for a week. EVT has recently contacted the participant and the lower pressure set-point is currently in use. However, this set-point change can easily be undone by the participant and cannot be expected to last for ten years.

The Department recommends that the measure life be for the pressure reduction be reduced from 10 years to 3 years.

- b) Grocery Store - Addition and Renovation  
EVT Project ID: 15421  
MAS 90 Job: 6014-1575  
Size Stratum: 2

This grocery store underwent an addition and renovation that included a new commercial glass reach-in refrigerator.

EVT claimed savings for this measure as an Energy Star commercial refrigerator, though EVT documents for the project clearly state it is not a qualified Energy Star appliance.

The savings were removed for this measure, resulting in a reduction of 557 gross, annual kWh, 0.06565 winter kW and 0.07339 summer kW.

- c) Plastics Manufacturer – Motors  
EVT Project ID: 350874  
MAS 90 Project ID: 6013-C361  
Size Stratum: 1

This plastics manufacturer installed five efficient pump motors for extrusion and related processes. EVT assumed a load factor of 0.75 for all five motors, EPACT baseline efficiencies, and NEMA premium efficiencies for the efficient case. EVT assumed 24 hour/day, 5 day/week, 52 week/year operation, and a measure life of 20 years for the efficient motors.

An older version of the prescriptive motor tool was used to generate the claimed savings estimate, resulting in an overstatement of the kW savings by a factor of 1.14.

In addition, EVT estimated 6,240 annual run hours for the project, and winter and summer peak demand coincidence factors of 1.00, based on production at the time of the project. When the DPS evaluation team interviewed the customer for the Forward Capacity Market project, it became apparent the run hours will be substantially lower due to the economic downturn. Also, EVT's annual run hours do not account for downtime and holidays.

The DPS analysis assumed that there will be periods of high economic cycle and low economic cycle during the measure life, with the plant operating one shift for one third of the measure life, and two shifts for two thirds of the measure life.

The Department recommends that the claimed energy savings be reduced by 3,093 gross, annual kWh and the coincident peak by 0.762 winter kW and 0.630 summer KW.

- d) Insurance Company Office Building - Server Upgrade 3  
Project ID: 372078  
MAS 90 Project ID: 6013-D458  
Size Stratum: 2

This insurance company installed virtualization software as part of a server upgrade at their main data center. The virtualization allows one server to act as multiple servers reducing the overall number of physical machines required. This project is one of several where EVT has tracked savings resulting from this upgrade. EVT uses information from the APC website to estimate the power consumption of the old servers and used a tool provided by HP to estimate the power consumption of the new blade servers.

After EVT obtained and provided additional information and analysis for this project, consensus was reached on an appropriate adjustment to the savings claims. The DPS calculated the appropriate capacity savings reductions based on the additional information provided by EVT.

As a result, the energy savings were reduced by 4,874 gross, annual kWh and coincident peak savings reduced by 0.561 KW for both winter and summer peak periods.

- e) Elementary School - Lighting Plus  
EVT Project ID: 323147  
MAS 90 Project ID: 6021-B574  
Stratum: 1

EVT's direct install contractor conducted a lighting audit including fixture counts, hours of operation, and recommended replacements. Occupancy sensors were installed as part of the project. The cooling bonus was claimed for all measures, although no documentation was provided that air conditioning was present throughout the building,

Savings were claimed based on 40 hours per week classroom occupancy for 52 weeks per year. However, the school is in session 40 weeks per year and all spaces are typically unoccupied two weeks during the school year for holidays and vacations. For all classrooms, the Department assumed 1600 hours of base operation and 2000 hours per year for other spaces. Also, the cooling bonus was removed for all except the office spaces.

The adjustments for the lighting control measures reduce energy savings by 1,829 annualized kWh and winter and summer peak demand savings by 0.215 KW and 0.404 KW respectively.

- f) Eyewear Manufacturer – Injection Molding  
EVT Project ID: 328872  
MAS 90 Project ID: 6014-B881  
Size Stratum: 3

This eyewear manufacturer installed three efficient injection molding machines and a compressor for compressed air application.

The DPS concluded that EVT's capacity savings estimate for the injection molding machines used assumptions more appropriate for large machines, not the small ones installed in this project.

The capacity savings were recalculated and result in a reduction of 3.021 KW for both the winter and summer coincident peak periods. There is no change in the estimated energy savings for this project.

- g) Ski Resort Hotel  
EVT Project ID: 213558  
MAS 90 Project ID: 6014-4466  
Size Stratum: 4

The efficiency measures installed in units at this Act 250 permitted resort hotel include Energy Star dishwashers and refrigerators and clothes dryer fuel switches from electric to propane.

The Department determined that the EVT claimed savings for the clothes dryer fuel switches did not appropriately reflect savings for 49 installed units, apparently due to a data entry error, since the energy savings were unrealistically low (196 kWh for all 49 units) and the coincident peak demand savings unusually high. EVT supplied revised savings estimates of 23,373 kWh, increased consumption of 90.2 MMBtu/year of propane, and Winter Demand Savings of 3.4 kW and Summer Demand Savings of 2.5 kW. The Department reviewed these new calculations and found them reasonable.

As this hotel is a commercial new construction project, EVT evidently applied a spillover rate for of 1.25 and a free rider rate of 0.95 for all these measures. While hotels are generally considered a commercial use, the measures installed in this project are more residential in use. Therefore, the free rider factors from the Residential New Construction program would be more appropriate and no spill over should be claimed for this project.

EVT requested that the Department make the adjustment to its gross savings (at the customer meter), since making a change to free rider and spillover values on a project-specific basis is complex in EVT's data tracking system. The result of this change, together with the clothes dryer savings correction, results in an increase of 14,215 gross, annual kWh, and a decrease of 5.224 winter KW and 3.968 summer KW. The MMBtu additional use is increased by 89.42.

- h) Downhill Ski Area - Snowmaking  
EVT Project ID: 360273  
MAS 90 Project ID: 6013-C602  
Size Stratum: 4

This ski area installed a new compressor in place of its aging compressors used for making snow. Although this is a MOP project, the savings calculation is based on the efficiency of the old compressors compared to the new compressor.

In order to correctly calculate savings, it is necessary to match the compressors' performance inlet and discharge conditions as closely as possible. A reasonable motor efficiency also needs to be used. The calculation should reflect higher motor efficiency (assuming 92%) and lower discharge pressure.

The Department recommends reducing the energy savings by 310,895 gross, annual kWh with a similar decrease in winter coincident peak demand savings of 27.754 kW.

## **D. Stipulated Lighting Projects**

### **1. Self Storage**

EVT Project ID: 370760

MAS 90 Project: 6014-C903

Size Stratum: 2

EVT used the lighting power density calculation to determine savings for this Act 250 new construction project. The project consisted of exterior lighting at a new self storage facility. Lighting included two pole mounted fixtures at the site entrance and 67 building mounted CFL fixtures evenly spaced on the five buildings on the site.

For the building mounted fixtures, EVT presumed that the fixtures were lighting either a 12 or 15 foot perimeter around each building and calculated the area based on that illuminated perimeter. The allowance for parking lots and drives was used (0.15w/sq ft + 5% additional allowance) per the 2005 Vt Guidelines. This yielded an allowable connected load of 8.92 kW. Hours of operation were assumed to be 50% of the year.

*DPS Issues:* The lighting power densities for building exterior do not seem to directly cover the project. There are two areas for consideration in determining the correct classification of the project under the code: 1) the intended purpose of the building installed lighting system, and 2) the applicable building exterior lighting allowance.

In this situation, the installed lighting does a poor job of illuminating the property for security purposes. The lights provide pools of light between the buildings with footcandle levels ranging from 0.1 to 5.3 giving a maximum to minimum ratio of 53/1. IESNA allows a 20/1 maximum to minimum ratio in general parking lot illumination. Because the lighting system does not provide the quality of lighting expected in a parking lot, using the parking lot allowance seems incorrect.

The Department considered three options for determining an appropriate baseline for the project, all of which yielded a baseline lower than the one that EVT selected. These options include the following:

- use a one-to-one fixture comparison, assuming a 100W incandescent baseline in comparison to the installed 28W CFLs, which yields a 6.7 kW (still code compliant) incandescent baseline.
- use the allowance for a walkway less than 10 ft wide (assuming the lighting is just illuminating a perimeter around the buildings), which, based on an allowance of 1.0 w/lf, yields a total allowance of 0.34 kW.
- use the building façade method which allows 0.2 w/square feet of illuminated wall area and gives an allowance of 2.476 kW of connected load.

The DPS has concluded that using the façade method is most consistent with the lighting design since it does not provide even illumination of any area on the property. Therefore, the DPS adjusted the savings for the 67 building mounted lights accordingly.

In the entry drive, the calculation for the entry drive can use the 1.6 w/sq ft, but needs to use the correct area. It appears that EVT use an area of 7,350 square feet in its calculation of savings. The DPS scaled the illuminated area of the entry drive and found the area to be about 4,800 sq ft.

Because of the quality of light issue, the most appropriate baseline is the allowed wattage applied only to linear footage of the façade that is in fact illuminated by the lighting system. In addition, the light levels will be much lower in the winter due to poor CFL performance in cold temperatures, again indicating that providing a high quality illumination solution for a parking area is not the intent of the lighting system. In addition, it appears that occupancy sensors would have provided significant additional savings while providing potentially enhanced security for the site.

*DPS Recommendation:* The DPS recommends a reduction of 24,846 gross, annual kWh and 5.475 and 0.289 kW for the winter and summer coincident peak demand savings.

## **2. Lumber Store- Lighting Plus**

EVT Project ID: 322215

MAS 90 ID: 6021-A642

Size Stratum: 2

This project involved a comprehensive lighting retrofit.

EVT claimed savings on 7 super T-8 fixtures in the sheetrock area. However, the direct install contractor report indicates that three fixtures were installed in this area.

Correcting the savings for this discrepancy reduces the energy savings by 2,523 gross, annual kWh, the winter and summer coincident peak savings by 0.309 KW and 0.599 KW, respectively, and reduces the MMBtu waste heat penalty of 2.8 MMBtu.

## **3. Middle School**

EVT Project ID: 370950

MAS 90 ID: 6013-C990

Size Stratum: 1

Measure ID: 1455280

Five high-bay T-5 fixtures were installed at this middle school. EVT claimed savings using prescriptive assumptions contained in EVT's TRM. The winter and summer coincident peak demand savings were estimated using the industrial lighting load profile with the cooling bonus.

The Department is primarily concerned with the use of the industrial lighting load profile. While prescriptive assumptions cannot be assumed to match the characteristics of every site, the industrial lighting load profile with the cooling bonus is more likely to represent the maximum possible coincident peak savings rather than an average over many types of projects. The Department has recalculated the coincident peak factors using more appropriate inputs for this specific application.

The result is a reduction to the winter and summer coincident peak savings by 2.013 KW and 4.070 kW, respectively. No change is made to the energy savings or MMBtu waste heat penalty.

#### **4. Housing Authority Apartments - CFL Switch (2 Projects)**

EVT Project ID: 331472, 338279

MAS 90 Project ID: 6017-B945, 6017-C078

Size Stratum: 2, 2

These projects involved the installation of CFL's in multifamily buildings in Winooski. The savings were calculated using the prescriptive values for direct install CFL's.

The quantify of bulbs installed suggests that twelve or more CFL's were installed in many of the apartment buildings. These units tend to be small and have only one or two occupants. Under these circumstances, reliance on prescriptive savings assumptions for each and every CFL installed does not produce a reasonable savings result. The Department's revised calculations are based on installing nine CFL's in each unit.

This change reduces the energy savings for project 331472 by 11,043 gross, annual kWh and the winter and summer coincident peak savings by 2.651 and 0.730 kW, respectively. For project 338279, savings were reduced by 22,779 kWh annually, and winter and summer coincident peak savings were reduced by 5.469 KW and summer peak by 1.505 KW.

### **E. Residential Adjustments**

#### **1. Home Performance with Energy Star**

##### **a) Central A/C**

*Description of EVT's Approach:* EVT installed 20 Energy Star central A/C systems through this program during 2008. EVT claimed 74 gross, annual kWh and 0.6710 summer peak coincident kW for each unit.

*DPS Issues:* This measure is characterized in the TRM. The claimed energy savings match the TRM. The summer peak coincident savings from the TRM are 0.2261 kW.

*Recommended Adjustment:* Correcting the summer coincident peak savings for the 20 central A/C systems results in a total reduction of 8.9012 kW.

##### **b) Shell Measures and Space Heat Efficiency**

EVT is using trained home performance contractors to complete comprehensive thermal shell upgrades to participant homes. Savings are calculated by the contractors using an EVT spreadsheet based tool. The values are then uploaded from this tool to EVT's database.

The electric savings from the auxiliary space heating resulting from shell and other space heating efficiency measures are calculated on a semi-prescriptive basis using a value of 7.39 kWh savings for every MMBtu saved, as documented in the TRM. Efficient furnace fans and heating systems are also characterized in the TRM.

A review of EVT's spreadsheet tool revealed several problems with the calculations in the tool, as well as inconsistent and sometimes erroneous data entry on the part of the home performance contractors. For example, the tool does not account for wall construction, e.g., stud spacing and construction method, and consequently it can overstate the savings from insulation. Inconsistent data entry include varying R-values per inch for a single type of insulation or the same R-value per inch used for a wide range of insulation types, including foam and cellulose. Additionally, the preexisting conditions were unusually low, in some cases using an R-value of 5 or less for a wall.

In addition, the method used to calculate electrical savings for heating system auxiliary electrical components is overstating the actual savings. Auxiliary electric savings, as documented in the TRM, are based on an assumed incidence of boilers and furnaces developed prior to the ramp up of this program. Program performance to date indicates that the mix of heating systems is far more complex and includes over 10% of participants using some type of space heater as their primary heating system.

The Department recommends reducing the annual energy savings by 36,682 gross kWh, 19.159 winter coincident peak kW and 2,517 MMBtu.

## **2. Residential Existing Buildings (HPwES and LISF)**

### **a) CFL Lamps**

The Department and EVT agreed that the savings for the direct install of CFL lamps could be claimed on a prescriptive basis rather than collected site-specific information for each bulb replaced. The prescriptive savings are based on the same assumptions used to estimate savings for the Efficient Products program, with an in-service rate of unity.

EVT has applied the prescriptive savings to all lamps, regardless of the number of lamps installed in each home. This approach has resulted in claiming savings of more than 2,000 kWh for CFLs in some homes.

The DPS agrees that it is acceptable to claim savings on a prescriptive basis. However, just as for the Efficient Products program, the DPS maintains that there need to be a cap on the number of claimed lamps per home. Otherwise, excessive savings are claimed for some homes. This issue has been raised previously for this program, the RNC in the 2007 verification report, and for the Residential Existing Buildings, Residential New Construction and Efficient Products initiatives.<sup>6</sup>

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<sup>6</sup> For example, the 2005 verification report discusses the unrealistically high per-household savings for some participants in the residential retrofit initiatives stemming from the method of claiming savings from multiple measures without regard to the overall effect (2005 Savings Verification Report, Section III.H.).

The DPS recommends that savings be claimed for no more than fourteen lamps in a single family home or dwelling unit. The Department has identified 224 participants who received more than fourteen lamps, for a total overstatement of savings of 96,291 kWh, 23.1189 winter peak KW and 6.3634 summer peak KW savings.

b) Refrigerator Replacements

A data entry error resulted in negative savings claimed for four refrigerator replacements. The Department corrected this error, which results in an increase of 8,838 gross, annual kWh, 1.053 winter peak kW and 1.096 summer peak kW.

**3. Efficient Products Program**

a) Energy Star Refrigerators

The TRM for this measure was modified in April of 2008 to reflect the changes made to the ENERGY STAR criteria. The adjustments were not correctly carried through to EVT's database. In addition, EVT incorrectly applied a 0.67 factor for both free riders and spillover when the spillover rate should have been 1.33.

These corrections result in an increase of 50,776 gross, annual kWh, 267,032 net kWh, and winter and summer peak savings of 6.05 kW and 6.30 kW, respectively.

**IV. Issues to be Addressed on a Prospective Basis**

**A. Operating Hours**

Business cycles should be a factor in determining annual and lifetime savings. The issues are covered in Section II, B above. The Department recommends that EVT adopt a process for incorporating the effects of economic cycles into the savings estimates.

**B. Baselines for C&I lighting**

During the 2008 verification review process, the Department has recognized that many of the baseline assumptions for C&I Lighting in the TRM are a number of years old. The Department requests that a complete review of the TRM C&I lighting baselines be conducted at part of the 2009 TAG process.

**C. Project Documentation and Availability of Information**

The lack of clear and complete project documentation continues to make verification efforts unwieldy and difficult. The level of documentation provided for many Lighting Plus projects, in

some cases only a CAT tool, made verification of those projects highly uncertain. In one case, critical information was entirely lacking for the preliminary findings review. In addition, the Home Performance with Energy Star inputs that form the basis of the savings appear to be unreliable.

In the SV 2007 verification report, the Department requested that EVT develop better, more consistent procedures for documenting operating, facility and runtime schedules and assumptions. However, this issue arose in a number of the projects reviewed in the SV2008 sample and it does not appear that this issue has been addressed by EVT in a comprehensive manner. The Department reiterates its request that EVT develop better, clear and consistent procedures for documenting operating, facility and runtime schedules and assumptions, and all other assumptions made in developing the savings claim.

When there is no means of connecting the installed measures to physical locations or other documentation, it is difficult to verify EVT savings. The combination of all these factors creates uncertainty that makes the verification process difficult and unpredictable.

#### **D. Act 250 Spill Over**

When Vermont enacted a general statewide commercial energy code for all commercial new construction in January of 2007, the Department and EVT made an agreement that would allow EVT to claim spillover for the new projects to adjust for the higher baseline and the transition period while the design community becomes more familiar with the new code. Under that agreement, EVT has been claiming spill over for Act 250 projects. The Department requests that EVT discontinue this practice for projects completed as of January 1, 2009. This issue should be added to the TAG list.

#### **E. Technical Reference Manual (“TRM”) Reliability**

The 2008 project review uncovered numerous errors in EVT’s Technical Reference Manual (“TRM”).<sup>7</sup> If the TRM is not reliable, the Department cannot ascertain whether a discrepancy between the claimed and TRM values is a mistake in the tracking system or the TRM itself. The Department recommends that EVT conduct a review of the TRM to ensure that it is accurate.

### **V. Sampling Methods and Analysis**

The sampling was done in two parts. First, projects from the primary sample frame were selected, including the non-stipulated measures for all C&I and multifamily projects. Second, a smaller sample from the stipulated lighting measures was selected. Both of these components of the sampling plan are described below. This section is divided into the following subheadings:

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<sup>7</sup> For example, the spillover factor on page 18 of the TRM 2009-55\_Rev A is listed as 0.7. The number should be listed as 1.3. Other examples were also found through the verification process.

overview, integration with FCM sample, sampling issues, differences between the SV2007 and SV2008 sampling plans, weighting, sampling results, stipulated lighting sample, and other analysis issues.

## **A. Overview of Sampling**

For SV 2008, the sampling plan was designed to be consistent with the sampling for the Forward Capacity Market ("FCM") evaluation project to allow overlap samples between verification and FCM samples. This approach led to a greater emphasis on the coincident peak demand savings and also on the availability of well documented coincident peak factors. For the FCM sample, the primary focus is on the uncertainty associated with the coincident peak savings, and consequently, the measures with stipulated load profiles that would not require metering were removed from the sample. Since the verification sampling was based on the FCM sampling plan, the main verification sample was drawn using the same criteria, i.e., measures with stipulated load profiles were excluded. However, recognizing that there are other critical inputs into the energy savings and TRB, the Department selected a second sample of the projects with stipulated load profiles.

For the main verification sample, the sampling unit was the project/end use with three end use categories, i.e., lighting, HVAC and other measures ("REST"). In SV 2008, samples were selected separately for two broad program groups:

- retrofit projects where pre- and post-installation metering may be possible, and
- market opportunity projects (MOP) and new construction (NC) projects where only post-installation metering could be implemented.

The retrofit projects included C&I retrofit, farm, and low income and market rate multifamily initiatives. The MOP and NC projects include custom MOP, prescriptive projects, NC and also the relatively new Lighting Plus initiative, which was based on the assumption that it would not be possible to pre-meter these projects since they are retrofit projects with a short lead time.

The primary stratification variable was the higher of the two estimates of coincident peak reduction (summer and winter) for each sampling unit (project and end use). The higher of the two coincident peak values is referenced as "max kW" throughout the rest of this document. Project/end uses with an estimated maximum peak reduction of less than 0.8 kW were omitted from the sample as too small to evaluate.

The sample was further stratified by size (small, medium and large) and by season (winter versus summer/nonseasonal). These categories were established for the FCM sampling and are used to ensure that the sample is representative of the population. Projects with a max kW greater than or equal to 0.8 and less than 5.0 were classified as medium, projects over 5.0 and less than 35.0 were medium and projects with maximum demand savings of 35.0 kW or higher were large.

Using the stratification system established for the FCM, there were 65 projects completed in 2008 that fell into the "large" category. Given that the DPS verification team has a short period to review a full range of projects, it was unrealistic to expect that the team would be able to review all of these large projects during the verification period. Consequently, the large projects were stratified into two categories for MOP/NC and three categories for retrofit projects. A stratified

random sample was selected from the lower strata. As in previous years, a census of the very largest projects was reviewed.

Additional details of the sampling plan for the main verification sample are explained in more detail in the memorandum provided to EVT and the Contract Administrator on May 12, 2009.

## **B. Integration with the FCM Sample**

The sampling plan from the FCM evaluation was adopted to allow for overlap between the two samples. This approach had numerous ramifications for savings verification, including the timing of the sampling, the selection of projects prior to completion and the wider range of evaluation activities conducted for the FCM.

The FCM sampling was done in stages. The original FCM sample was selected for projects that were completed between January 1, 2007 and April 30, 2008. Thus, there were some 2008 projects that were included in the FCM sample. To complete the verification sample, additional projects were selected from projects completed in 2008 that were not included in the initial FCM sample. The sample sizes for verification were determined based on the characteristics of the projects completed in 2008.

Sixteen projects included in the verification sample were selected previously in the small and medium categories for the FCM sample. In some cases, the DPS evaluation team had been on site and collected metered data prior to or during the verification period. Where available, data gathered through the FCM evaluation have been used to inform the verification process. This information may include installed counts and an enhanced understanding of the operating conditions and schedules, as well as the metered data.

## **C. Sampling Issues**

This process was quite complicated and led to a few anomalies, as might be expected. Two specific issues are explored in more detail below: changes in size categories between the initial and final samples and the designation of end use categories.

Retrofit projects sampled through the EMT process and also 2008 projects selected during the first stage of the FCM sampling were chosen before the projects had been through EVT's finalization of savings. Some of the projects in the population and in the sample were found to be in a different size category when the final 2008 savings were available. In the sample, there were three projects that moved from one size category to another. Two projects were initially in the small or medium categories and later found to be in the "too small to evaluate" category; one project was originally in the medium category and moved to the large category. As is consistent with the sampling plan, these projects were kept in the stratum designated in the original sampling.

Designation of the end use categories was based on EVT's measure codes. However, these measure codes were not designed for this purpose and did not always result in the correct outcome. For example, motor measures were placed in the "REST" category, but some motors were used in HVAC applications. It also turned out that a few lighting efficiency measures had the measure code for lighting controls, which placed them in the "REST" category for retrofit projects. These issues were minor, and easily resolved within the context of the project review.

End use assignments were particularly problematic for Lighting Plus. The initiative is a turn key operation designed to facilitate the installation of efficiency lighting in existing C&I buildings. These retrofit projects were initially placed in the MOP/NC group due to the lack of potential for pre-installation metering. However, the lighting control measures were inadvertently categorized in the other measure group. For future sampling efforts, this initiative should be included in the retrofit category to avoid further confusion.

## D. Differences between the 2007 and 2008 Verification Sampling Plans

The critical differences between the two sampling strategies are summarized below in Table 3 below.

**Table 3: Differences between SV2007 and SV2008 Sampling Plan**

Topic	SV2007	SV2008	Reason
Program Groups	Custom BEF Prescriptive BEF C&I NC MFB NC & Retrofit	Retrofit MOP/NC Stipulated Lighting (MFB and C&I combined)	FCM sampling based on ability to obtain pre-install metering
Sampling Unit	Project	Project/End use	FCM sampling plan stratified by end use
Timing	Sampling done after all projects completed and EVT QC conducted	Sampling done in stages Completed projects selected prior to EVT QC	FCM required pre-install metering Initial sampling frame included 2008 completed projects prior to EVT QC
Size Strata	Established from completed projects in sample frame Equal sample sizes within each stratum	Determined prior to project completion Some projects moved between strata Sample sizes were not equal within each stratum	FCM required cut offs for pre-install sample and for staged sampling

## E. Weighting

Developing the expansion weights was complicated by the staged sampling and the integration of the FCM and SV2008 sample. The steps in the sampling process are listed below.

- Projects were categorized by the four stratification variables: program group, end use, size and season (winter v summer/non-seasonal)
- The first stage sample was selected for the FCM in July of 2008, including projects completed through April 30, 2008. (Measures with stipulated load profiles were separated from the main sample.)
- The second stage sample was selected to fill out the SV 2008 sample with projects completed from May 1, 2008 through December 31, 2008.
- The FCM "large project" group was divided into categories and the smaller strata were sampled for SV2008.

- For the large projects, the stratification variables were program group and size. All sampling was done at the same time, so there was no need to identify the projects according to the stage in which they were selected.
- The stipulated lighting sample of 20 was selected. The stratification variables were program group and size and all sampling was done at the same time.

For the main sample, the fact that the sample was selected at two different times from two separate sample frame indicates that the sampling probabilities (and therefore the expansion weights) will be different within each stratum for stage one and stage two. In addition, there were numerous cells with no sample in either stage one or stage two, so the weights had to be scaled to reflect the entire population. Tables 8 and 9 contain the expansion weights for the main sample, and the weighted for the stipulated sample are provided in the following section.

**Table 8: Main Sample Expansion Weights for Small and Medium Projects**

Program Group	Size Category	End Use	Season Category	Weights for Round 1 Projects	Weights for Round 2 Projects
Retrofit	1	HVAC	1	0.0000	7.8930
Retrofit	1	HVAC	2	0.0000	0.0000
Retrofit	1	LTG	1	0.0000	0.0000
Retrofit	1	LTG	2	0.0000	32.6994
Retrofit	1	REST	1	0.0000	17.4773
Retrofit	1	REST	2	11.6569	0.0000
Retrofit	2	HVAC	1	0.0000	4.5103
Retrofit	2	HVAC	2	6.0819	0.0000
Retrofit	2	LTG	1	16.7251	0.0000
Retrofit	2	LTG	2	18.2456	22.5513
Retrofit	2	REST	1	0.0000	7.8930
Retrofit	2	REST	2	11.6569	9.0205
NC/MOP	1	HVAC	1	0.0000	0.0000
NC/MOP	1	HVAC	2	0.0000	30.4443
NC/MOP	1	LTG	1	0.0000	16.9135
NC/MOP	1	LTG	2	45.6140	77.8021
NC/MOP	1	REST	1	21.2865	30.4443
NC/MOP	1	REST	2	10.6433	45.1026
NC/MOP	2	HVAC	1	0.0000	6.7654
NC/MOP	2	HVAC	2	0.0000	8.6447
NC/MOP	2	LTG	1	0.0000	9.0205
NC/MOP	2	LTG	2	27.3684	14.5174
NC/MOP	2	REST	1	0.0000	4.5103
NC/MOP	2	REST	2	7.6023	13.5308

**Table 9: Main Sample Expansion Weights for Large Projects**

Program Group	Size Category	# of Projects	# of Projects in Sample	Weights
Retrofit	3	19	6	3.16667
Retrofit	4	13	6	2.16667
Retrofit	5	10	10	1.00000
NC/MOP	3	14	5	2.80000
NC/MOP	4	4	4	1.00000

## **F. Sampling Results**

The sample sizes were established according to the methodology presented in the California Framework (Framework).<sup>8</sup> Since the focus is now on peak demand reduction and the DPS evaluation team is relying on metering for the FCM verification, the error ratios were assumed to be 0.60 for lighting efficiency measures and 0.75 for HVAC and other measures. These values are significantly higher than has been found in our previous verification studies and were employed to try to ensure that the sample size would be sufficient to meet the ISO requirements.

Table 1 below shows the number of projects and the sample sizes in the two major program groups by size category. Size category 0 is the "too small to evaluate" group. As can be seen from Table 4, the "too small to evaluate" projects account for only 2% of the total kW Max demand reduction.

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<sup>8</sup> TecMarket Works, et. al. The California Evaluation Framework. Project Number: K2033910. Prepared for the California Public Utilities Commission and the Project Advisory Group. June, 2004. Pages 327 to 339 and 361 to 384.

**Table 4: Summary of Projects by FCM Strata**

		All Projects	Sampled Projects	All Projects	Sampled Projects
Program Group	Size Stratum	# of Projects	# of Projects	kW Max	kW Max
Retrofit	0	337	0	63	0
Retrofit	1	209	7	476	12
Retrofit	2	171	17	2,066	279
Retrofit	3	44	22	2,290	2,283
Totals		761	46	4,895	2,574
NC/MOP	0	1419	0	209	0
NC/MOP	1	434	11	976	19
NC/MOP	2	215	20	2,578	252
NC/MOP	3	19	9	1,342	1,005
Totals		2,087	40	5,105	1,276
Stipulated	0	494	0	123	0
Stipulated	1	447	8	965	20
Stipulated	2	115	12	1,114	128
Totals		1,056	20	2,202	148

As discussed above, the large projects under the FCM size categories were further broken out into strata to allow for the completion of the project review within the verification time frame. This stratification is summarized in Table 2 below. Since the cut offs were established based on completed project information and final savings estimates, each stratum represents a relatively equal proportion of program activity. As has been done in the past, a census of the largest projects was reviewed.

**Table 5: Summary of Projects by Verification Strata<sup>9</sup>**

		All Projects	Sampled Projects	All Projects	Sampled Projects
Program Group	Stratum	# of Projects	# of Projects	kW Max	kW Max
Retrofit	0	220	0	63	0
Retrofit	1	195	7	496	12
Retrofit	2	166	17	2,144	279
Retrofit	3	22	6	987	244
Retrofit	4	11	5	550	268
Retrofit	5	11	11	983	983
Totals		625	46	5,225	2,574
NC/MOP	0	681	0	212	0
NC/MOP	1	434	11	990	19
NC/MOP	2	215	20	2,618	252
NC/MOP	3	15	5	737	201
NC/MOP	4	4	4	625	625
Totals		1,349	40	5,182	1,276

The final sample included 46 retrofit and 40 MOP/NC projects. The projects were selected randomly within each stratum. The distribution of sampled projects in terms of the size of the projects is presented below in Table 6, which reflects the verification stratification with the FCM large projects broken out into separate strata. This analysis shows that projects vary in size from 0.000 to 301 KW reduction. The zero values in the retrofit strata 2 and 3 reflect the fact that projects moved from one size category to another when the savings were finalized and some projects that initially were categorized as small, medium or large were later found to be in the "too small to evaluate" group.

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<sup>9</sup> This table was updated from the sampling memo of May 12 to ensure that all stipulated measures and projects were removed.

**Table 6: Distribution of Sample by Project Size**

	Stratum	# of Projects	Min (kW Max Reduction)	Max (kW Max Reduction)	Mean (kW Max Reduction)	# Projects in Sample
Retrofit	1	209	0.000	17.593	2.375	7
Retrofit	2	171	0.000	40.006	12.541	17
Retrofit	3	22	0.000	77.384	46.845	6
Retrofit	4	11	73.578	114.425	93.343	5
Retrofit	5	11	93.587	264.26	139.874	11
Subtotal Retrofit		424	0.000	264.26	14.710	46
MOP/NC	1	434	0.804	4.998	2.28	11
MOP/NC	2	215	1.508	34.347	12.179	20
MOP/NC	3	15	22.182	125.927	55.508	5
MOP/NC	4	4	137.445	301.419	191.608	4
Subtotal MOP/NC		648	0.804	304.419	7.795	40

The next table shows the distribution of savings by end use for the two groups. The top census strata for both groups was removed from this analysis, since all of these projects will be reviewed. Thus, the percentage of savings in Table 4 reflects only the lower tiers (strata 1 through 4 for retrofit and 1 through 3 for MOP/NC). Since the end use was one of the stratification variables, the sample is reasonably well distributed among the three end use categories.

**Table 7: Comparison of Sample and Population by End Use**

	Retrofit		MOP/NC	
	Sample	Population	Sample	Population
	% of kW Max Reduction			
HVAC	6%	9%	27%	19%
Lighting	56%	51%	39%	57%
Other Measures	38%	40%	34%	24%

The sample was also checked to verify that it represented the variety of market tracks offered by EVT. The sample includes projects in twelve of the fifteen market tracks among the C&I and multifamily initiatives. The three tracks omitted from the sample are the low income rehab, farm MOP and farm retrofit. In combination, these three tracks account for about 2% of the total max kW achieved during 2008.

## G. Stipulated Lighting Sample

The Department selected a sample of stipulated lighting projects to investigate the impacts of standard assumptions, such as baseline and efficient conditions, on the coincident peak savings. The sample size was chosen based on the maximum number of projects the Department could possibly review with the time frame (20).

The FCM size stratification system was also applied to the stipulated lighting projects, based only on the measures with stipulated load profiles. The kW Max was determined for each stipulated project and projects with a total kW Max of up to 0.8 were removed from the sample as too small to evaluate. Small projects were defined as those with stipulated kW Max savings of over 0.8 kW and less than 5.0 kW, and medium projects had kW Max savings of 5.0 kW to less than 35.0 kW. Large projects of 35 kW or more were not included since the Department and Efficiency Vermont agreed to review the application of the stipulated load profiles on a case-by-case basis for these projects.

The twenty projects were evenly divided between the two major program groups, retrofit and MOP/NC. The sample was further separated into size categories based on their relative contribution to the kW Max savings. Table 10 below shows the number of projects and the expansion weights for the stipulated projects.

**Table 10: Stipulate Lighting Sample and Expansion Weights**

Program Group	Size	# of Projects	# in Sample	kWMax Total	kWMax Sample	Expansion Weight
Retrofit	Too small	78	0	27.98	0.00	None
Retrofit	Small	71	3	148.25	4.94	23.667
Retrofit	Medium	29	7	392.50	90.64	4.143
MOP/NC	Too small	475	0	95.36	0.00	None
MOP/NC	Small	376	5	817.22	14.74	75.200
MOP/NC	Medium	85	5	721.03	37.80	17.000

The sample size was based on the number of projects that could be reviewed within the time frame rather than achieving a specific level of statistical precision. Given the results of this analysis, which seem to suggest that it is necessary to conduct some review of projects with stipulated load profiles, this sampling strategy will need to be restructured for the FCM evaluation.

## H. Other Analysis Issues

There are a couple of issues regarding the analysis that require clarification. In 2008, VEIC had BEF projects with savings attributed to both the PSB contract and VEIC's contract with Green Mountain Power (GMP). The measures were identified by flag in EVT's database and 69% of the savings were allocated to the PSB contract and 31% to GMP. This process made the calculation of the realization rate more complicated for the C&I sample. The realization rate was determined for

the combined total savings and then EVT's portion of the savings was calculated, and the realization rate applied to those savings.

In addition, changing the sampling unit to the project/end use creates some potential issues when the selected measures interact with other measures that were not selected in the sample. This situation arose quite infrequently. For the one or two measures where this issue arose, the DPS also corrected the measure(s) that were not in the original sample, and included the non-sample measures in both the numerator and denominator when calculating the realization rates.